E907- An overview

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Fermilab

A Brief history of P907

ï Started as a proposal in the 1997 Workshop on Fixed target physics at the Main Injector. Presented an EOI in July 1997

ï Submitted 1st proposal in April 1998- received sufficient encouragement from PAC to acquire the Bevalac EOS-TPC from BNL after its use in E910

ï PAC asked for a new proposal in July 1999 which resulted in a more detailed proposal in June 2000

Format of the Talk

ï Review Purposes of experiment

   a Physics motivated measurements
      ï Scaling Law tests
      ï Nuclear Scaling
      ï Strangeness excesses due to QGP or rescattering? E910 and P907 relevance to RHIC

   a Service measurements
      ï Inclusive Cross sections for simulations ñGeant4, Mars, Atmospheric neutrinos
      ï Neutrino Factory/ Muon Collider target measurements
      ï MINOS target measurements

ï Review quality of existing data

ï Review Progress made in the last year

   a TPC,DAQ,Magnets,Chambers,RICH, Monte Carlo,Calorimeter,Beam,experimental hall

ï Proposed New ìDouble Slow Spillî

ï Running Schedule ñSY120 project and schedule.

ï Work to do to get the experiment on floor + Manpower Issues.
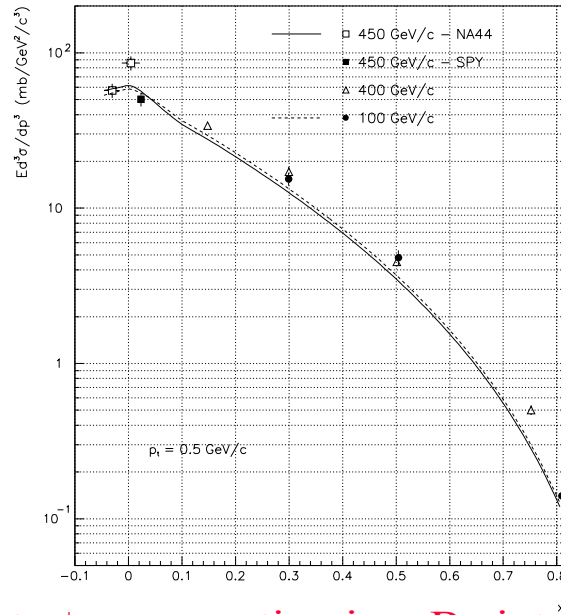
Quality of existing data
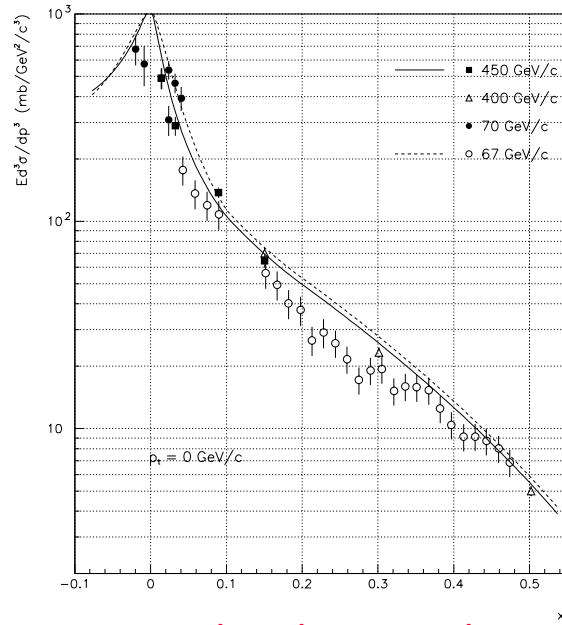
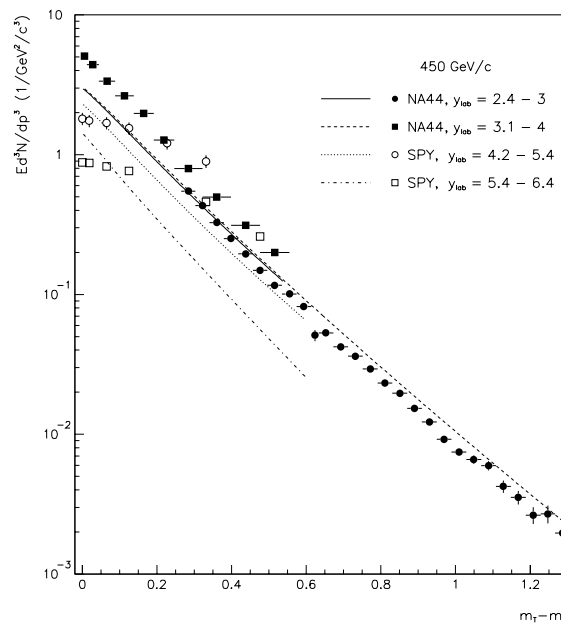ï Invariant π⁻ cross section in p Be interactions as a function of Feynman x at p_t=0 GeV/c
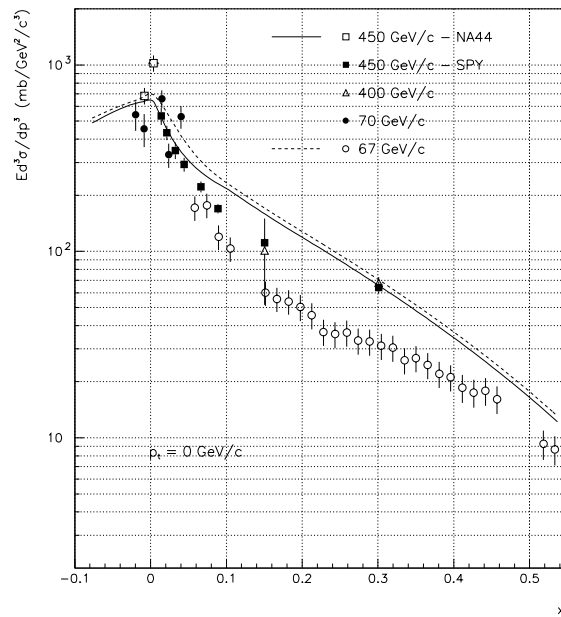
ï Invariant π+ cross section in p Be interactions as a function of Feynman x at p_t=0 Gev/c

Quality of existing data

ï   Invariant π^+ cross section in p Be interactions as a function of Feynman x at p_t=0.5 GeV/c

ï   Invariant π+ cross section in p Be interactions as a function of pion transverse mass.More fitting going on.

Quality of existing data

ï   Single arm spectrometers have inherently more systematics than open geometry appartus such as P907. This is because they must change geometry frequently of the single arm and make assumptions in calculating acceptances.

ï   Also single arm spectrometer data are sparse and for discrete p_t bins. The running time is adjusted to give a certain number of particles in the apparatus for that setting.

ï   Open geometry experiments (P-907, E910 at BNL) sample the phase space uniformly and continuously. They can separate primary pion spectra from pions induced by the decay of kaons etc. They necessarily need a slow spill mode of operation.

ï   Last open geometry experiment at these beam energies with particle id capabilities was the EHS. Bubble chamber instead of TPC. 3 years to scan and analyze 1 million events. We can do this in less than two days.

Purposes of the experiment

ï   To measure the identities and momenta of particles produced in $\pi^\pm, K^\pm, p^\pm$ interactions on various nuclear targets and hydrogen as a function of beam energy from ~5GeV/c-120GeV/c with high statistics and make these events public in 4 vector form on mass media such as DVDís. This will be ì Fermilab data setî .This will enable the user (theorist or experimentalist) easy access to data and help spawn new approaches to understanding these non-perturbative phenomena.

ï   Physics Topics

   a   Study hadronic fragmentation in particular, test a scaling law of particle fragmentation

   a   Search for exotic resonance such as glueballs

   a   Measure particle production off various nuclei-Nuclear scaling, RHIC physics.

ï   Service measurements

   a   Atmospheric neutrinos cross sections of pions and protons on nitrogen and oxygen in the 5GeV/c-120GeV/c momentum range

   a   Measure particle spectra with 120 GeV/c protons on the NUMI target on a timescale commensurate with MINOS needs.

   a   Neutrino factory/Muon Collider target measurements

   a   Indirect benefit for collider experiments by helping with Geant cross sections. Will help the GEANT4 project enormously to have measured cross sections rather than approximate models if a precision tool is to be built.

General scaling law of particle fragmentation

ï   States that the ratio of a semi-inclusive cross section to an inclusive cross section

$$\frac{f(a+b \rightarrow c+X_{subset})}{f(a+b \rightarrow c+X)} \equiv \frac{f_{subset}(M^2,s,t)}{f(M^2,s,t)} = \beta_{subset}(M^2)$$

ï   where M^2, s and t are the Mandelstam variables for the missing mass squared, CMS energy squared and the momentum transfer squared between the particles a and c. PRD18(1978)204.

ï   Using EHS data, we have tested and verified the law in 12 reactions (DPF92) but only at fixed s.

ï   The proposed experiment will test the law as a function of s and t for various particle types a ,b and c for beam energies between ~5 GeV/c and 120 GeV/c to unprecedented statistical and systematic accuracy.
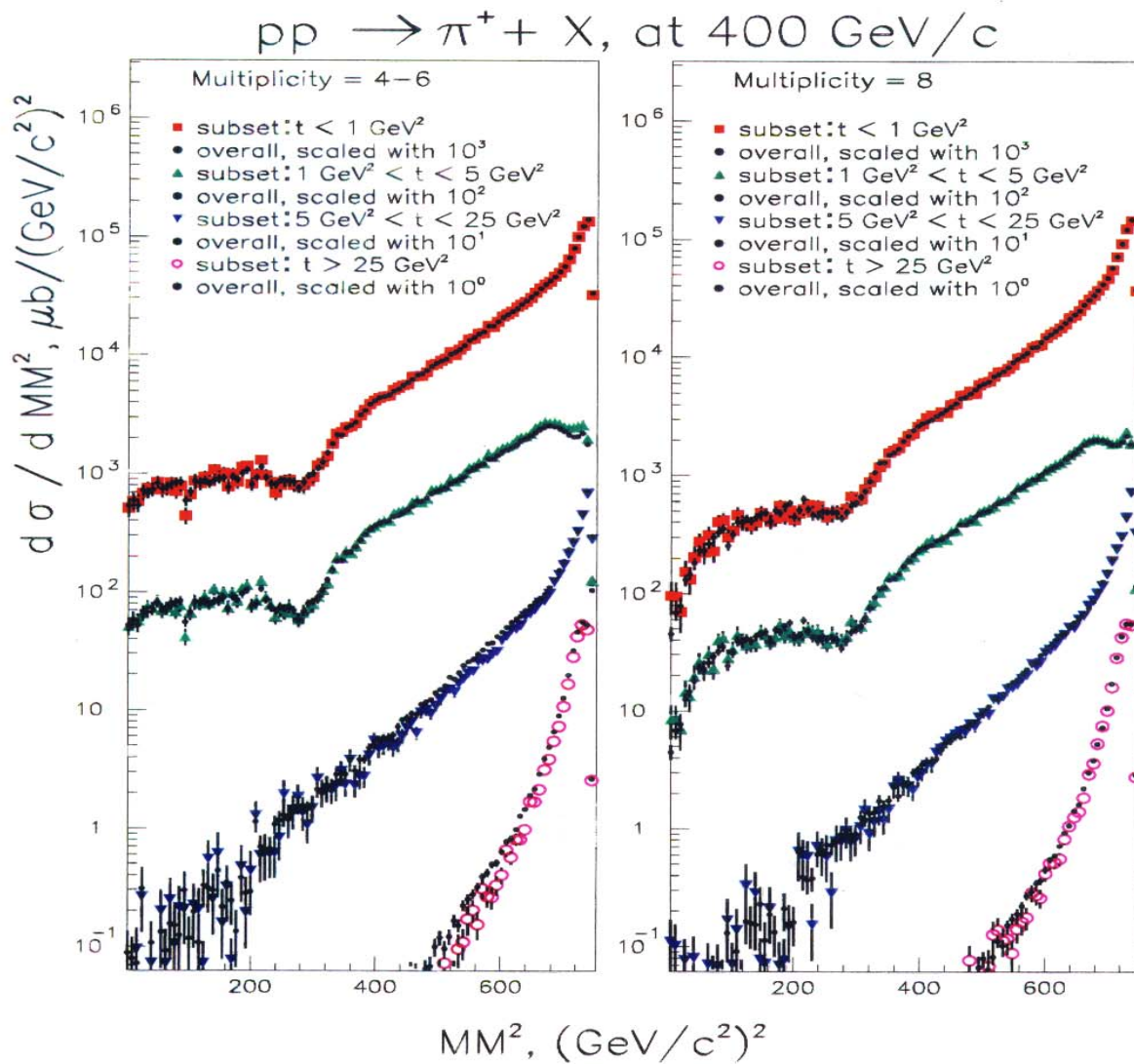
Scaling Law

ï   Physics behind law is the factorization of 3 body scattering cross section.

ï   We will be able to test the scaling law for 36 reactions as a function of s and t for various subsets with unprecedented accuracy.

ï   For each subset, we will be able to test the equality of the branching function for sets of crossed reactions. E.g $\pi^- p \acute{o} > p+X$ and $p\emptyset p\ \acute{o}\ >\pi^+ + X$ should have the same set of branching functions $\beta_{subset}(M^2)$! One is a diffractive process and the other a central process.

Scaling Law-EHS results

$$pp \longrightarrow \pi^+ + X, \text{ at } 400 \text{ GeV/c}$$

Scaling law -EHS results

pp $\rightarrow \pi^+ + X$, at 400 GeV/c
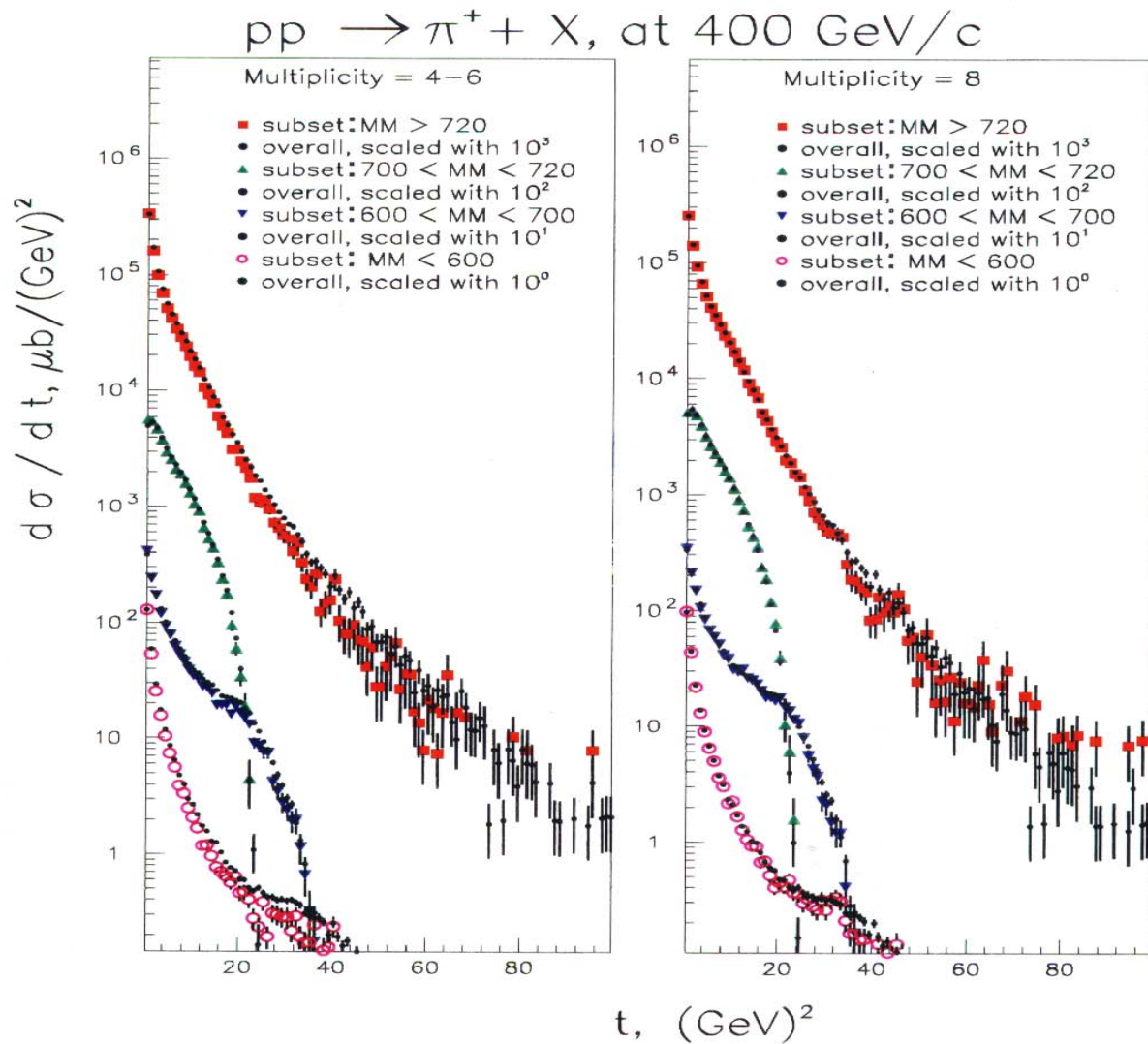
Nuclear Physics Measurements

ï   y scaling. y may be thought of as the component of the struck nucleonís momentum along the direction of the momentum transfer. The scaling function is independent of q^2 and represents the nuclear momentum distribution This is verified in ep scattering. Jerry Peterson (Vice Chancellor of Research, University of Colorado) and team want to extend this to hadron nucleus scattering. They have tested this at KEK with low energy hadron beams (E352). P907 provides the ideal apparatus, without modification, to extend this beyond the resonance region.
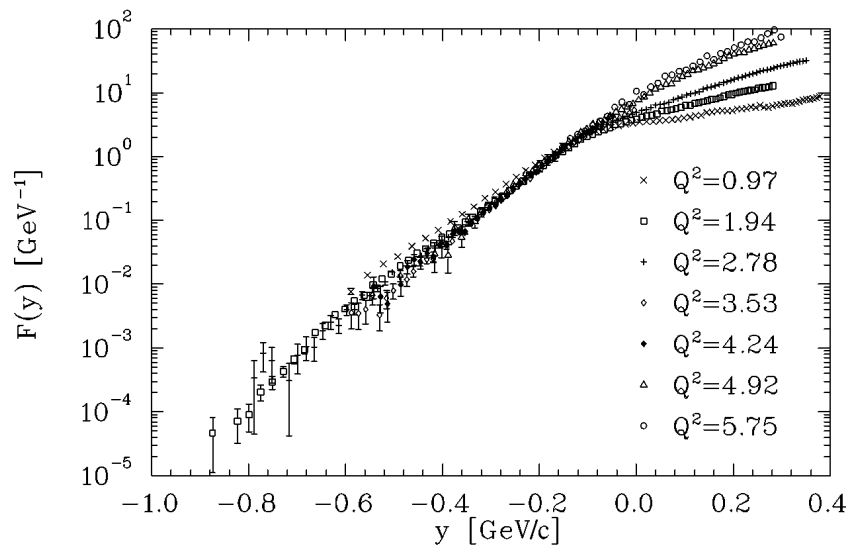

FIG. 2.   Scaling function $F(y)$ for Fe.   The Q^2 values are given for Bjorken $x = 1$.

Nuclear Physics Measurements

ï Another type of scaling is called ì Superscalingî and is derived from ì Relativistic Fermi Gas modelî of the nucleus. The scaling function is independent of nucleus. Observed in ep scattering. P907 will extend these tests to hadron beams.
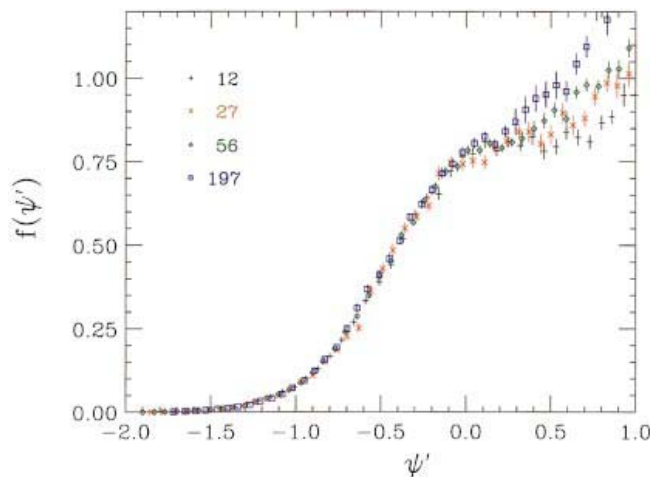

FIG. 3. (Color) Scaling function for C, Al, Fe, and Au and fixed kinematics ($q \approx 1000$ MeV/c).

ï Peterson wants to present P907 at the Dec 1 Town meeting of the Division of Nuclear Physics at TJNAF as a topic to be included in the new long range nuclear physics plan.

ï Larry Pinsky and Collaborators (U.of Houston and NA49) have joined us. They are interested in pA physics in general and would like to transfer the data to particle Monte Carlo codes.

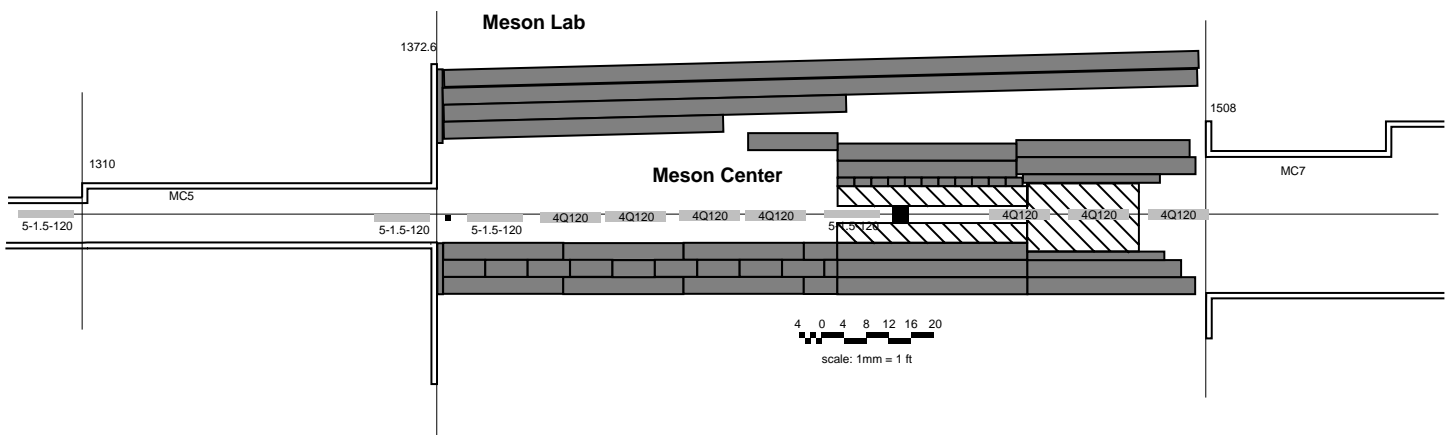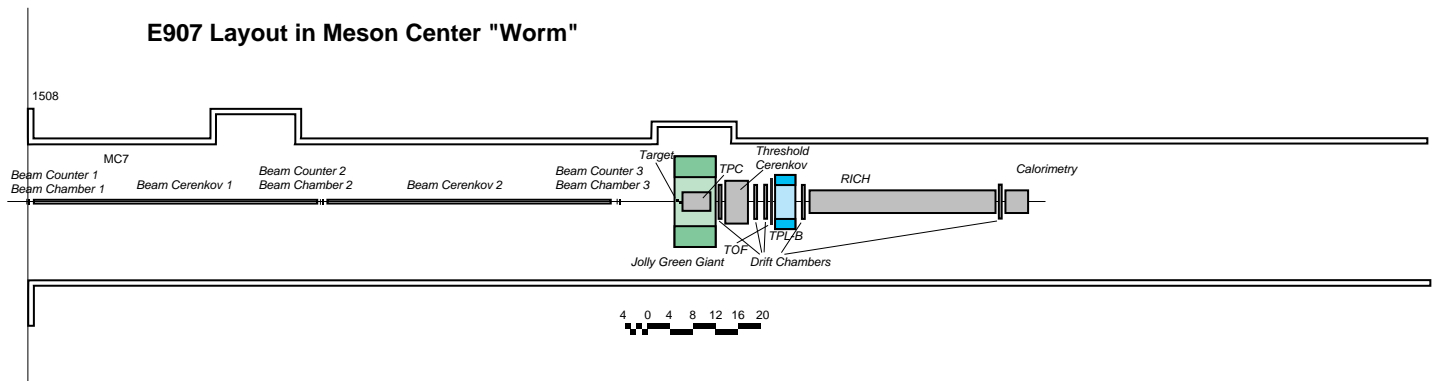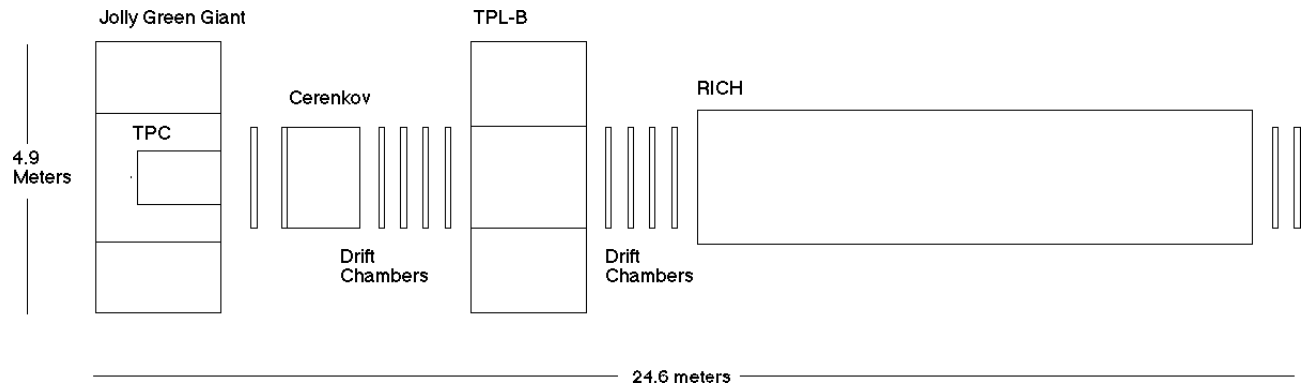ï Ron Soltz will cover the relevance of P907 measurements to RHIC physics and QGP.

Ph.D thesis topics from P907

ï **Nuclear Scaling**
- a Demonstration of y scaling
- a Extraction of in-medium hadron-nucleus cross sections
- a Exploring the physics for y>0
- a Analyzing the large loss inclusive spectra for N* excitations in nuclei

ï **Scaling law tests**
- a 6 beams species can produce 6 different topics each with 6 different inclusive final states

ï **Glueball searches and hadron dynamics**
- a Looking for exotic final states in an open geometry experiment with full particle id
- a Revisit Regge theory with much improved statistics and systematics

ï **Strangeness enhancement in nuclear interactions**
- a Can some of the QGP signals be explained as being due to multiple nuclear interactions?

ï **Passage of particles of tagged flavor through nuclear matter. Kaons and antiprotons**

ï **In short, E907 is rich in thesis topics and will provide graduate students training in hardware, software and analysis, since the timescale to do the experiment is once again commensurate with thesis time scale.**

Service Measurements

ï   Neutrino Factory/ Muon Collider target measurements. Measurements of pion and proton cross sections on targets suited to neutrino factory/muon collider needs are necessary to estimate yields of muons accurately. HARP experiment at CERN will do the low energy part of these measurements. But if a proton source such as BNL AGS or the Japanese JHF is used, P907 data will be of relevance.

ï   Atmospheric Neutrinos- Atmospheric Cosmic ray shower models (some of them one dimensional!) use Beryllium cross sections to extrapolate to Nitrogen and Oxygen. HARP will cover the low energy part of these measurements. P907 will cover the complete range in energy ~5 GeV to 100 GeV.

ï   MINOS needs- The hadro-production spectrum on a MINOS target can be measured with the Main Injector Beam that closely matches the beam emittance used in NUMI.

Experimental Setup

Jolly Green Giant

TPL-B

RICH

Cerenkov

TPC

4.9 Meters

Drift Chambers

Drift Chambers

24.6 meters

E907 Layout in Meson Center "Worm"

1508

MC7

Beam Counter 1
Beam Chamber 1

Beam Cerenkov 1

Beam Counter 2
Beam Chamber 2

Beam Cerenkov 2

Beam Counter 3
Beam Chamber 3

Target

TPC

Threshold Cerenkov

RICH

Calorimetry

Jolly Green Giant

TOF

TPL-B

Drift Chambers

4   0   4   8 12 16 20

Meson Lab

1372.6

1310

MC5

Meson Center

5-1.5-120

5-1.5-120

5-1.5-120

4Q120   4Q120   4Q120   4Q120

4Q120   4Q120   4Q120

1508

MC7

4   0   4   8 12 16 20

scale: 1mm = 1 ft

EOS-TPC

ï   This Time Projection Chamber, built by the BEVALAC group at LBL for heavy ion studies currently sits in the E-910 particle production experiment at BNL, that has completed data taking. It took approximately $3million to construct.

ï   Can handle high multiplicity events. Dead time 16 microseconds.

ï   Electronic equivalent of bubble chamber, high acceptance, with dE/dx capabilities. Dead time 16μs. I.e unreacted beam swept out in 8μs. Can tolerate 10^5 particles per second going through it.

ï   Can handle data taking rate ~60Hz with current electronics. Can increase this to 100 Hz with an upgrade.

ï   TPC dimensions of 96 x 75 x 150 cm.

ï   TPC is sitting in Lab7 flowing Nitrogen. It has been tested with 10KV HV and it holds the voltage indicating that the trip from BNL was uneventful.

2 GeV Au+Au

TPC dE/dx Particle ID- BNL E910

1000 MeV/A Au+C
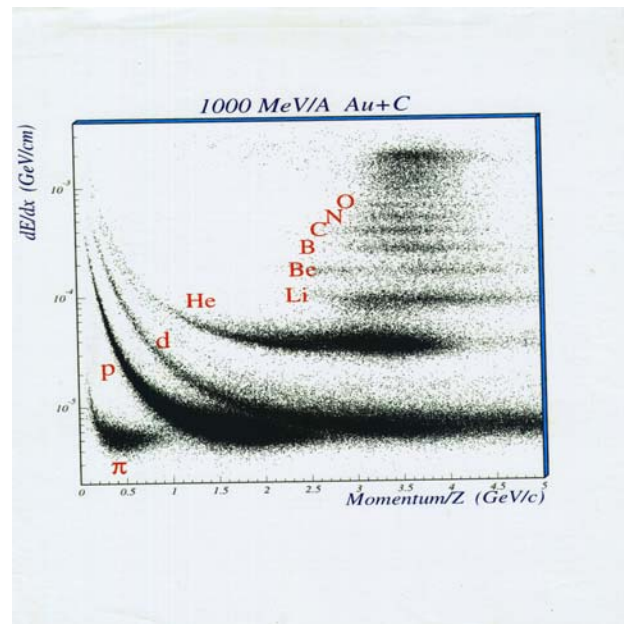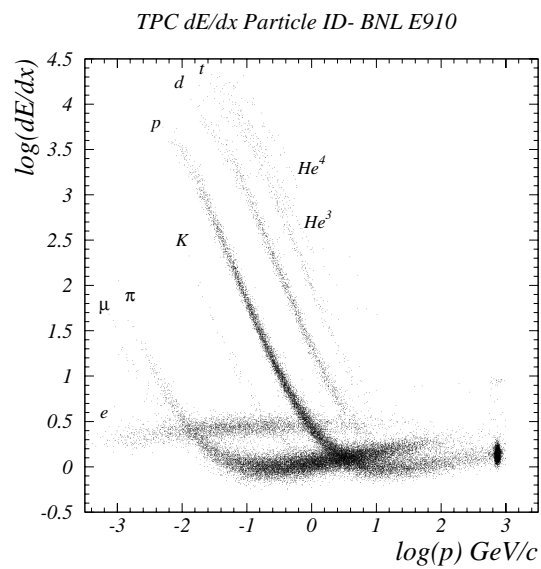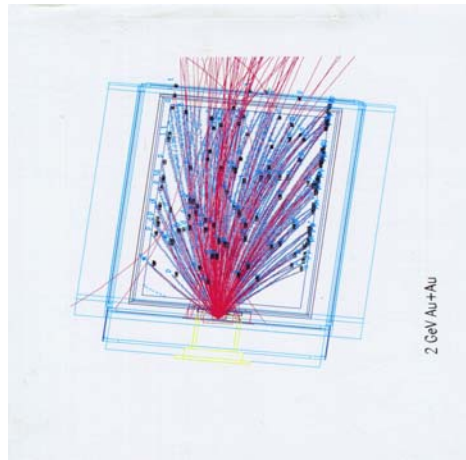
TPC status-October 2001

ï   Clean Room Constructed.


ï   Chiller refurbished and hooked up

ï   Gas system installed. Under N_2 currently. Will flow P10 once beyond the safety review.

ï   System cabled up. Low voltage supplies checked

ï   TPC front-end electronics (ì Sticksî) talking to DAQ

ï   Cosmic Ray tests scheduled for October 2001

Cosmic Ray test stand

ï   With the help of a Summer Teacher (Tom Las) and Pat Richards, we have a functioning cosmic ray test stand in Lab 6.
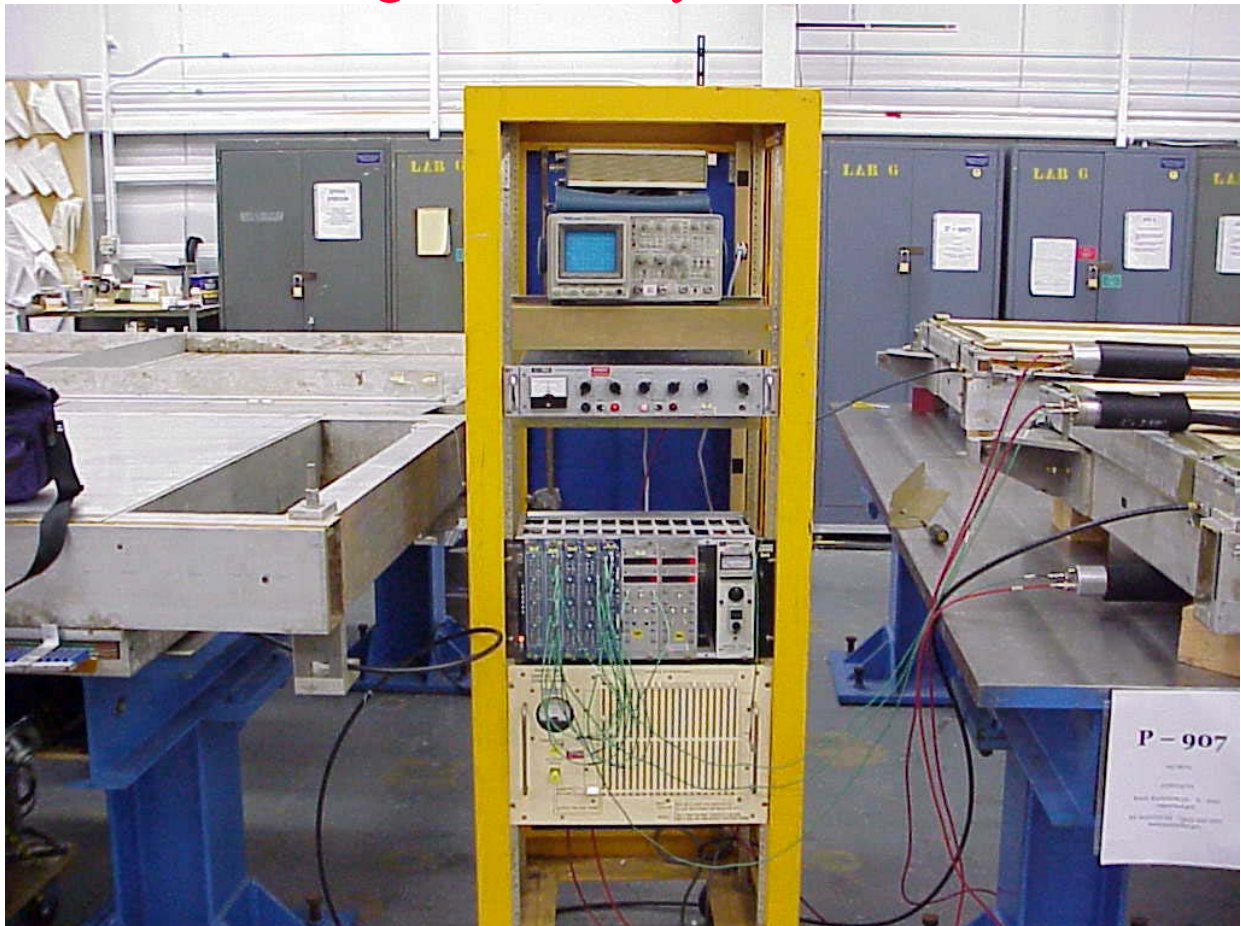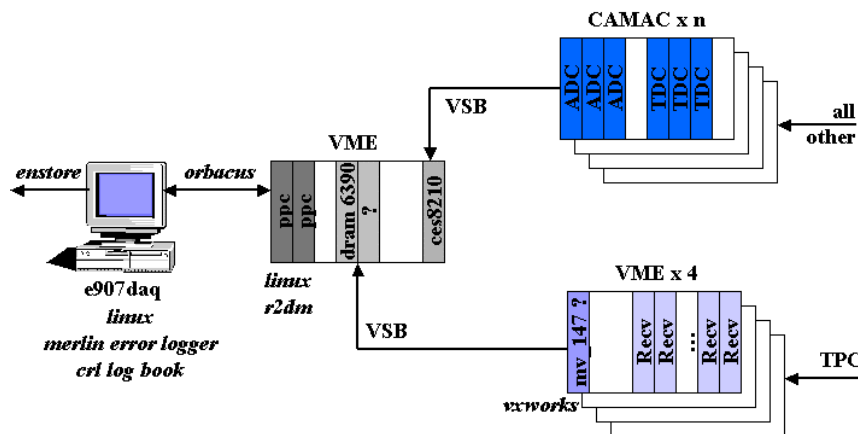
Cosmic test stand

Data Acquisition System

ï The Data Acquisition system is being redesigned with the help of Fermilab Computing Division (M.Votava,D.Slimmer and L.Piccoli) E907 Members (R.Soltz,B.Cole,D.Asner, M.Heffner) working on this.

E907 DAQ

ï Currently able to download data via the slow path. Optical link will soon be UP. Will try to go for cosmic ray tests in October.

ï More details in

[a] http://ppd.fnal.gov/experiments/e907/TPC/DAQ/e907daq.html

Monte Carlo

ï   Based on D0 Run I RCP based data-driven geometry.

ï   We have a fully functional Geant based Monte
     Carlo.(T.Bergfeld,D.Lange,R.Raja). Used for geometry
     optimization and TOF studies. More details in

> [a]   http://ppd.fnal.gov/experiments/e907/MC/e907mc.htm
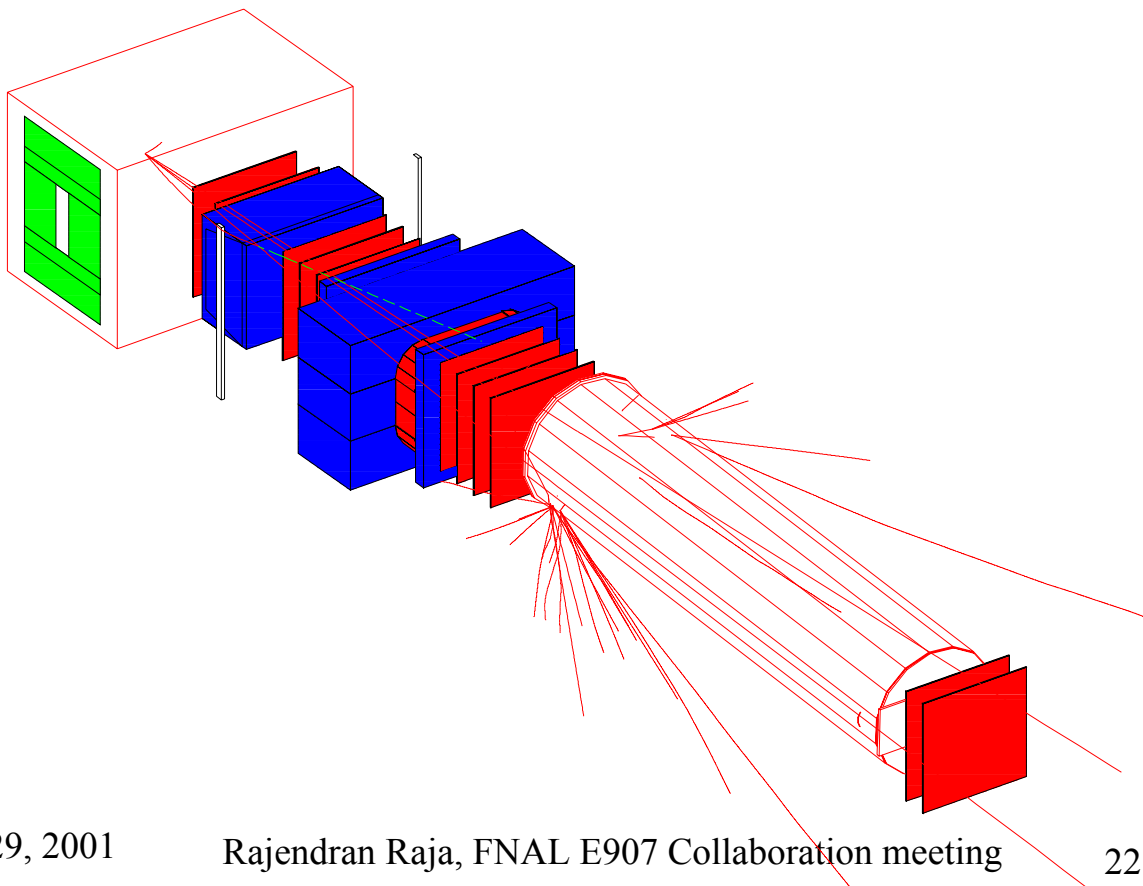
ToF system

ï   ToF system is being designed and built by University of SouthCarolina(T.bergfeld,A.Godley,S.Mishra,C.Rosenfeld). Details to be found in

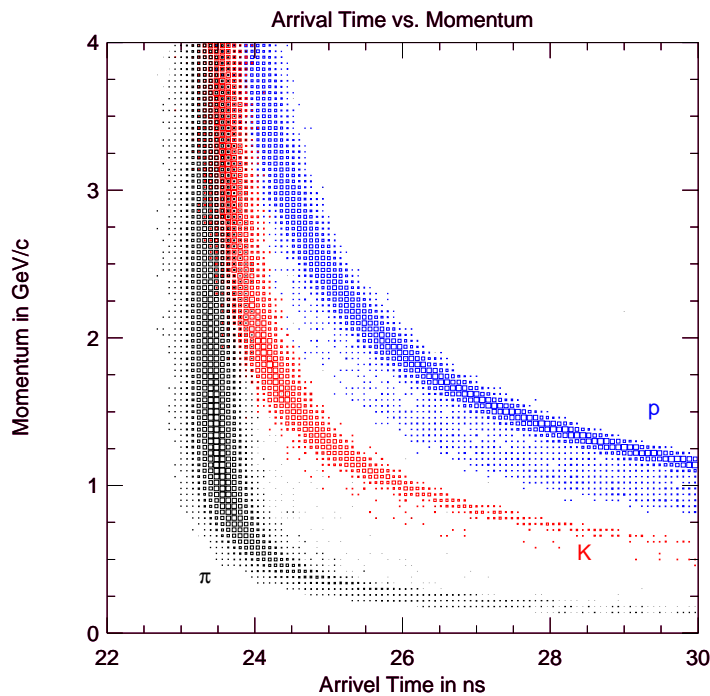   [a]   http://ppd.fnal.gov/experiments/e907/TOF/TOF.html

Figure 13: The normalized hit times as a function of momentum for π's in black, kaons is red and protons in blue. These times have assumed a detector resolution or 100ps on the detector and initial times.

RICH

ï   Refurbishing Selex RICH. Had Russian engineer (who helped build this for SELEX) visit FNAL for 1 month.

ï   Debugged Photo tubes and front-end electronics (need to replace hybrid chips or rebuild piggybacking on CKM)

ï   Tested readout with PCOS latches available from PREP

ï   More details at

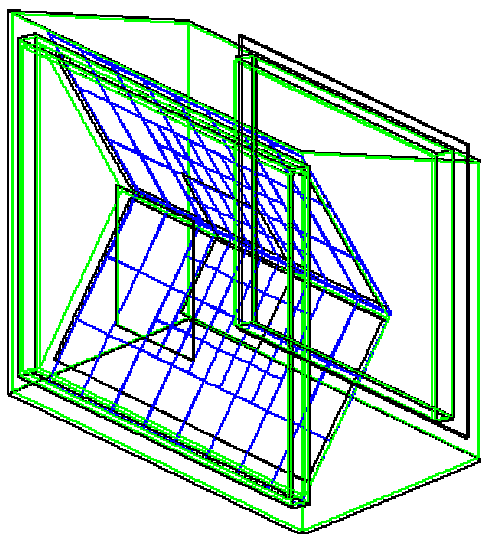   a   http://ppd.fnal.gov/experiments/e907/Rich/Rich.html
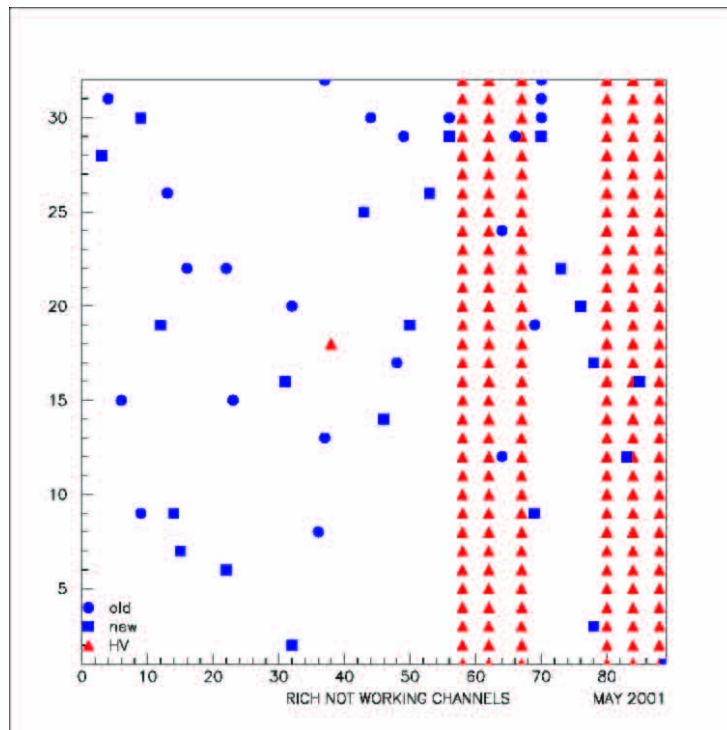
Chambers

ï E690 chambers (6 of them) extracted from storage. All tested OK for HV with N2 flowing. Gas system designed and passed safety walkthrough. Plan cosmic test in October.

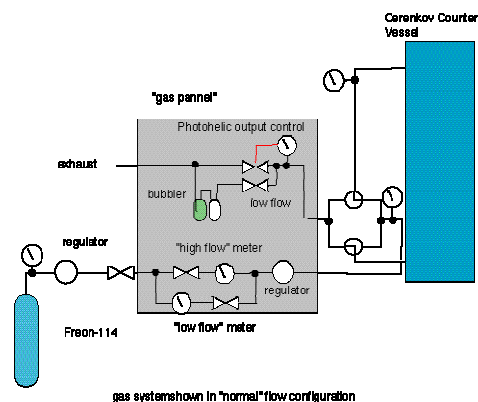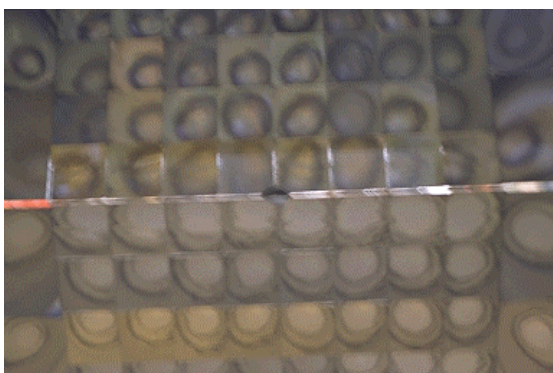ï (B.Mayes,L.Pinsky,J.Peterson,J.Brack)

ï Readout needs minor redesign.

E690 Cerenkov

ï   All pieces in hand. Needs assembly. Details in

    [a] http://ppd.fnal.gov/experiments/e907/Cerenkov/Cerenkov.html

35	38	39	40	41	42	45	48
34	37	4 8 12 16 20 24 28 32 3 7 11 15 19 23 27 31				44	47
33	36	2 6 10 14 18 22 26 30 1 5 9 13 17 21 25 29				43	46
81	84	49 53 57 61 65 69 73 77 50 54 56 62 66 70 74 78				91	94
82	85	51 55 59 63 67 71 75 79 52 56 60 64 68 72 76 80				92	95
83	86	87	88	89	90	93	96

Livermore ICO

ï   Lawrence Livermore National Laboratory has issued an ICO (Integrated Contractor Order) for $228,629. This has been used by Fermilab to do the following.

ï   Fix Jolly Green Giant Coil

ï   Clean out Hyper CP experiment

ï   Engineer Support Structure for Shoring Up M-Bottom to support the magnets (Jolly Green Giant and Rosy)

ï   Build and Install Support Structure.

ï   Build 1í concrete slab to support magnets.

ï   Purchase Roof materials to raise the roof of MC7 to accommodate the magnets.

Magnets and chambers

- We need two magnets. One with high aperture to measure the target fragmentation particles. The other to measure the forward high momentum particles.
- We propose to use the Jolly Green Giant magnet for the target fragmentation region. It has enough aperture (262x124x221 cm)to accommodate the TPC. 7 KG field.
- For the forward magnet we propose to use the ROSY magnet.
- Drift Chambers can be recycled from E-690. Dimensions 180x120cm., with 200Microns resolution. There are others in surplus at the lab.
- May be necessary to have a proton recoil detector.TPC does a good job on this. This decision must await Monte Carlo optimization.

Jolly Green Giant Magnet Coil fixed

ï   We have shipped out a faulty coil in the Jolly Green Giant magnet to California. Coil needed to be ì Unwound, bad conductor excised, re-insulated, rewound and re-pottedí.
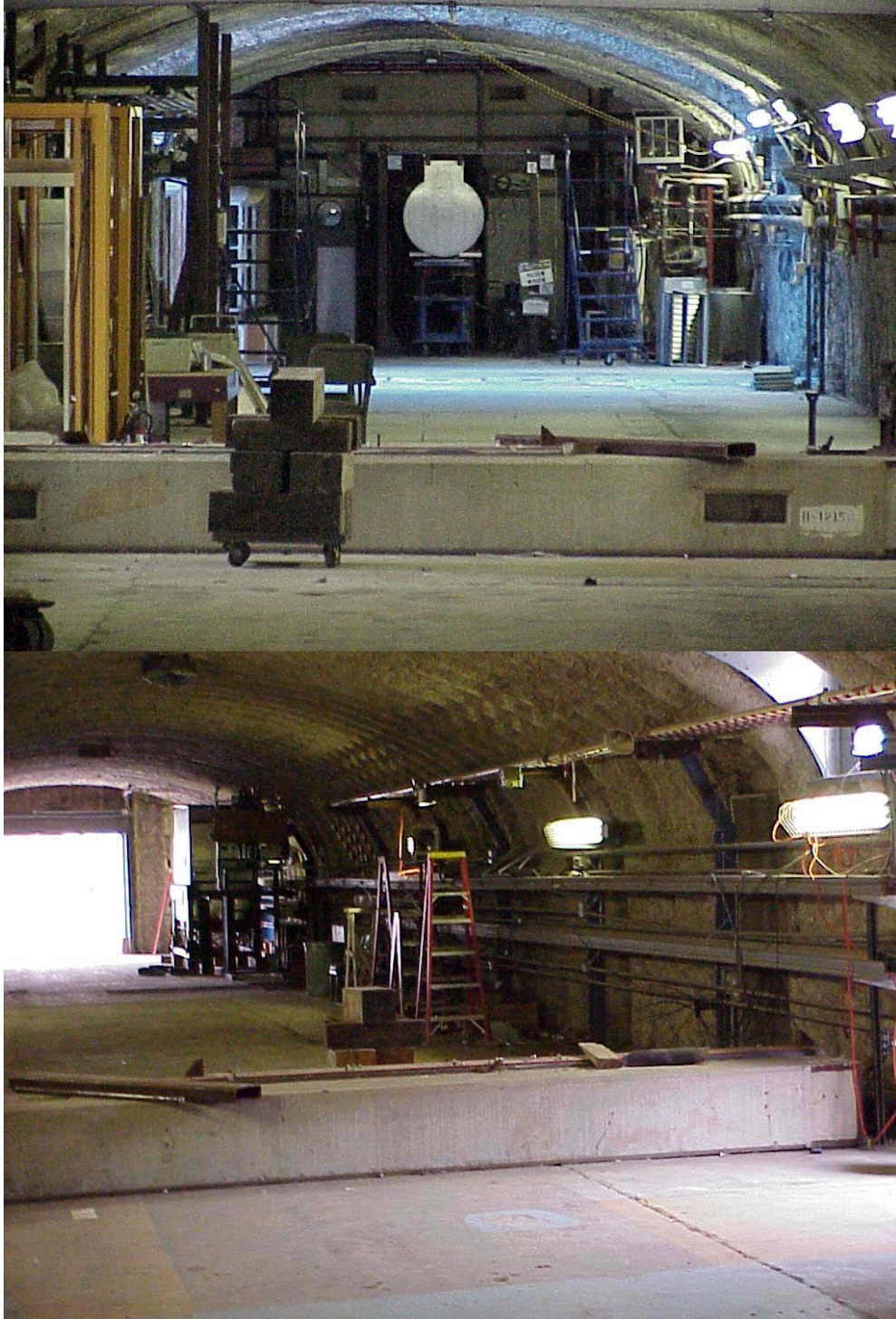
ï   Coil has passed ì Ring testî.

Experimental Hall- MC7

ï   We have paid to clean out Hyper CP experiment.

ï   Mbottom has to be shored up to support magnets (Complete)

ï   Concrete Slab (1ft high) in MC7 to spread load of magnets.
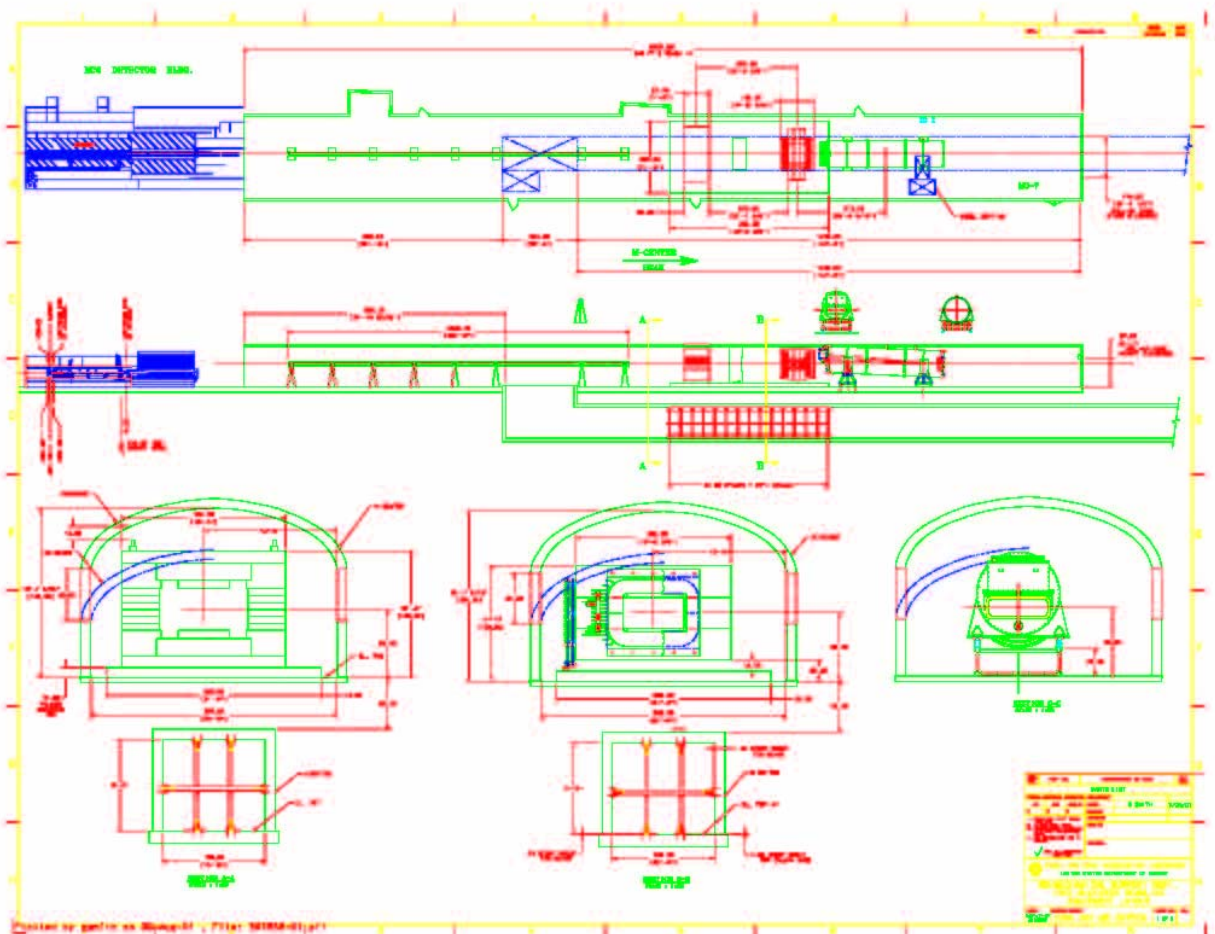
Experimental Hall -MC7

M-Bottom Shoring work

[a] details at
http://ppd.fnal.gov/experiments/e907/MC7Enclosure/MC7_Enclosure.html

Calorimeter

- ï Hyper-CP calorimeter being recycled. (H.Gustafson,M.Longo)
- ï Need Picture.

Particle Identification

- ï TPC as shown can provide 3σ separation with dE/dx up to 0.7 GeV/c for π/K and 1.1 GeV/c for K/p as well as ambiguous additional information in the relativistic rise region.

- ï In the intermediate region, we propose to use the Cerenkov detector of E690 (E766) currently at BNL E-910. Light is collected by 96 phototubes from reflective mirrors. Filled with Freon 114, the Cerenkov thresholds for π, K, p are 2.5, 7.5 and 17.5 GeV/c.

- ï Above 7.5 GeV/c, many particles will go through to the RICH counter and be identified. We plan to use a RICH counter of the type used by the SELEX experiment. At SELEX, counter was filled with Neon at 1.05 Atm.

ï Threshold	Ne	N_2	CO_2
ï π	12	5.7	4.9
ï K	42	20	17
ï p	80	38	33

TOF System and PID acceptances

ï In order to bridge the gap in Particle id between the TPC and Cerenkov systems, we plan to put in a TOF counter system with 100 ps resolution which would provide 3σ separation π/K up to 2.7 GeV/c and K/p up to 4.6 GeV/c, nearly filling the present particle id gap. Further Optimization studies are in progress.

PID Acceptance (positives)
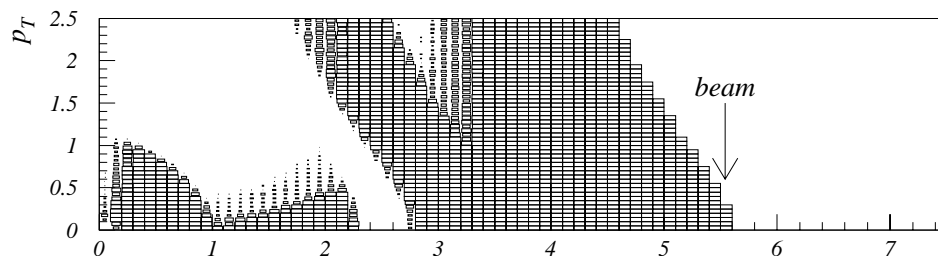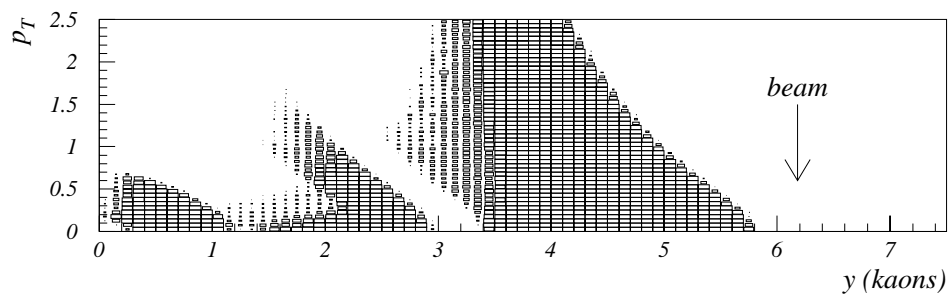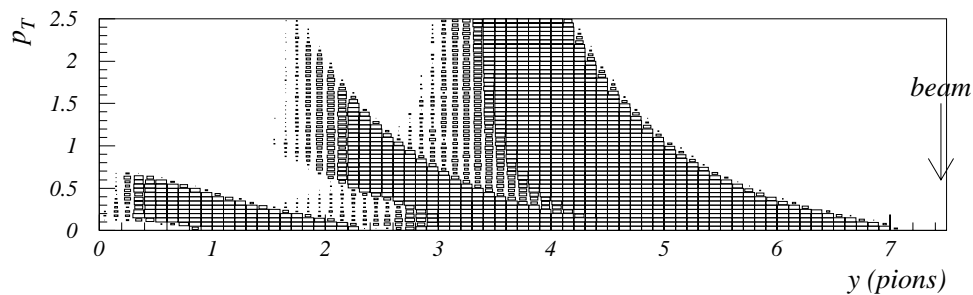
SELEX RICH characteristics
J.Engelfried et. al, NIM A431:53-69, 1999
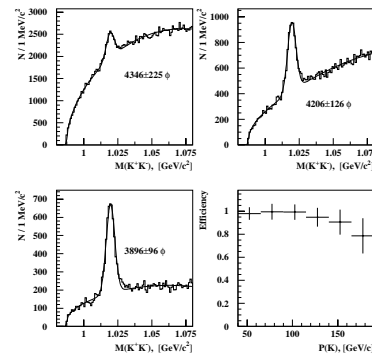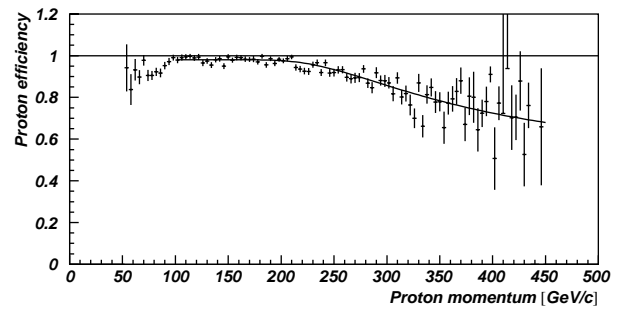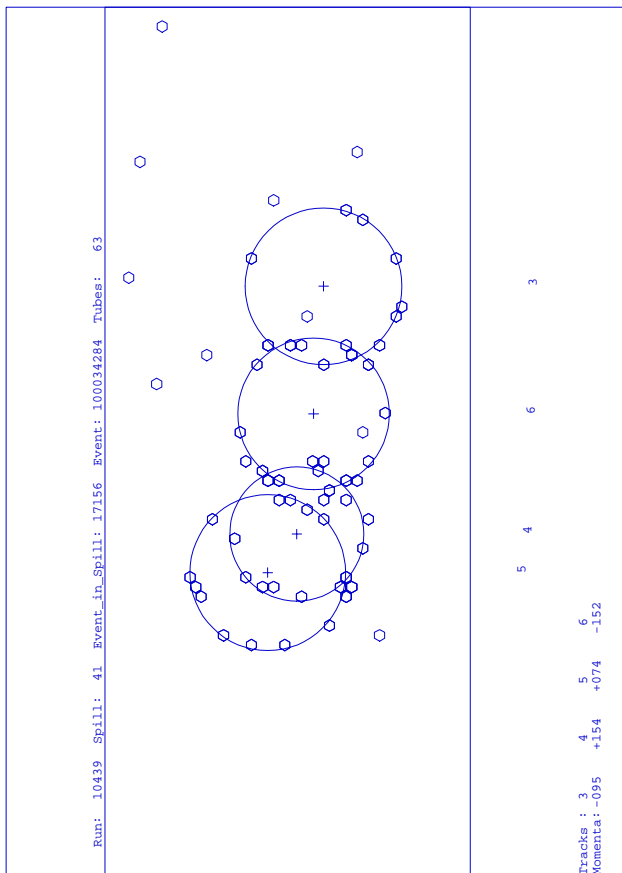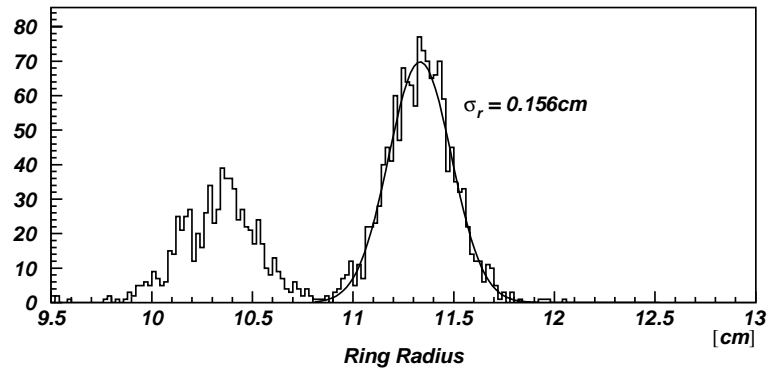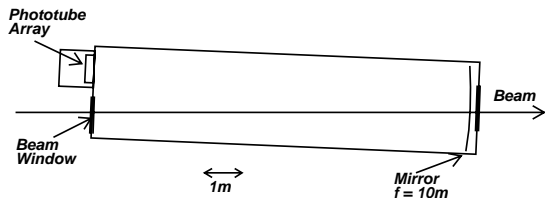
Particle acceptances and resolutions

ï   a)10 Hits in TPC

ï   b)a hit in the Cerenkov

ï   c)a hit in Drift Chamber 10 (just before RICH)

ï   d)Passage through mid-Z plane of RICH.

ï   Regular Target and NUMI target

ï   Four cases of particles considered

ï   (Cumulative AND)

Positive Particle Acceptance Efficiency
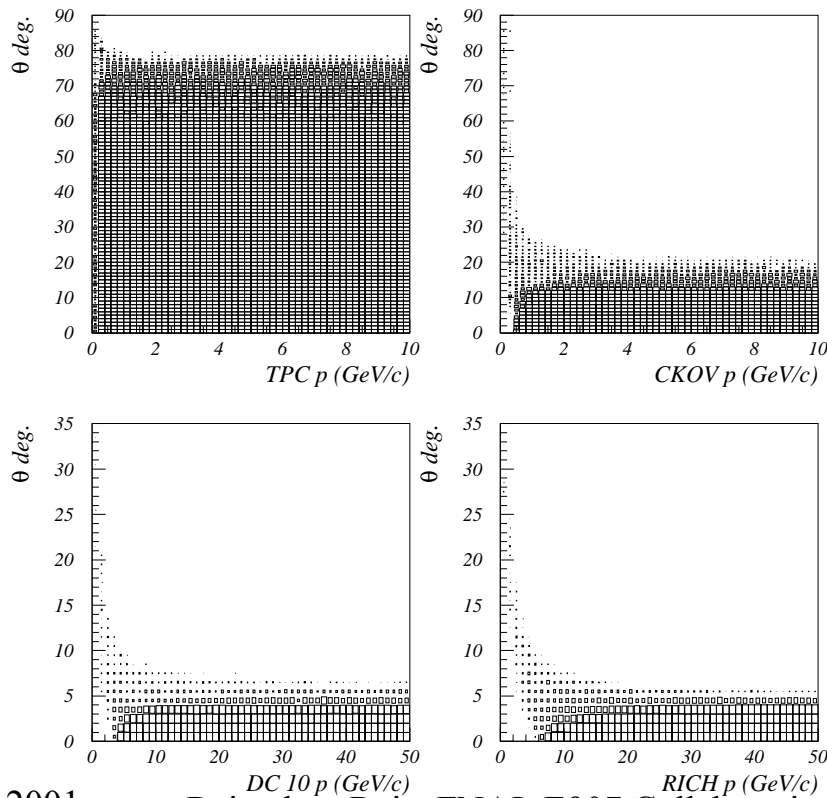
Particle acceptances and resolutions NUMI case

NUMI Front Acceptance Efficiency

Parameterized Momentum Resolution
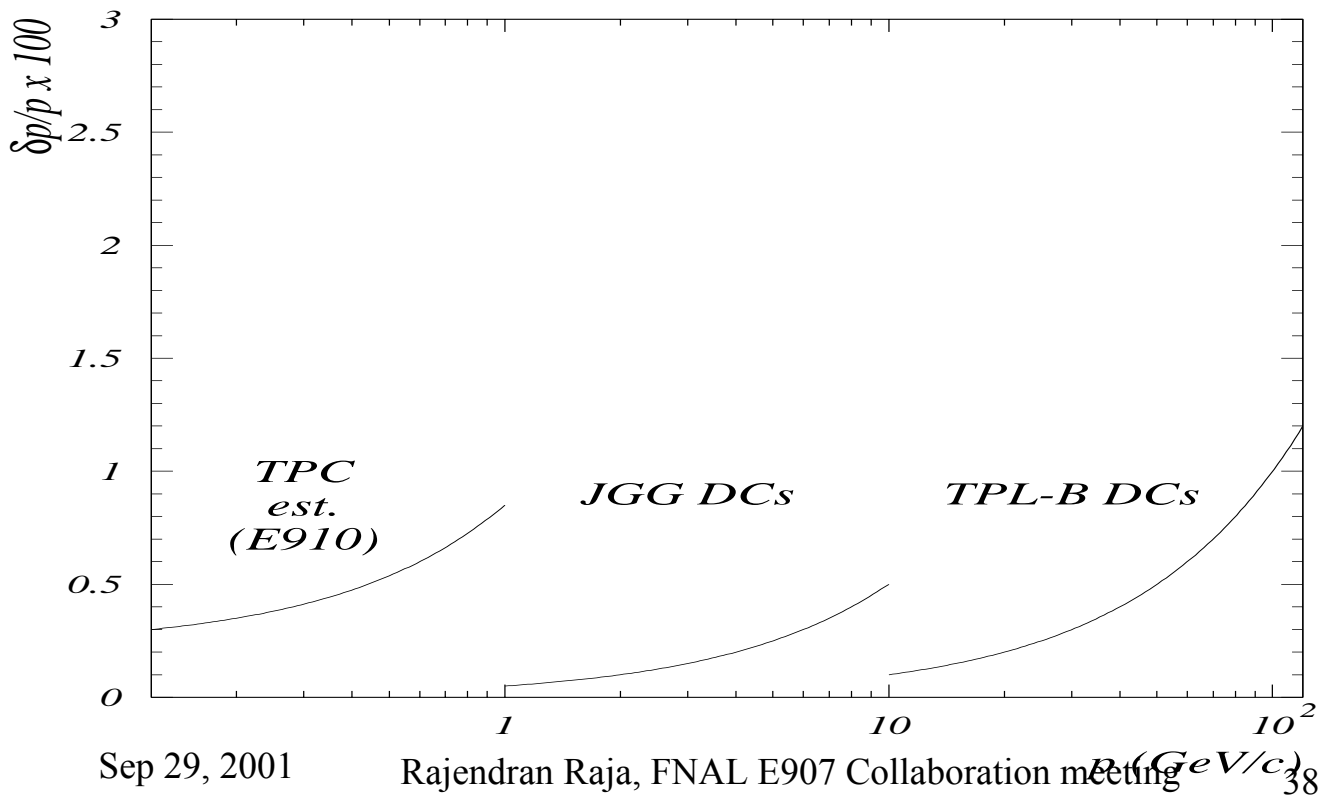
New Double Slow Spill Scheme

ï   The pure pbar cycle, where one booster batch is sent to anti-proton takes 1.467 seconds and results in 2455 shots to Pbar per hour.

ï   In the old ì Single Slow spillî scheme, one would send a booster batch to pbar at the beginning of the slow spill and use the remaining booster batches for slow resonant extraction to Meson. This results in 1200 pbar shots per hour, reducing pbar luminosity by a factor of 2. This would give 1200 seconds of Slow spill per hour to Meson. Unacceptable!

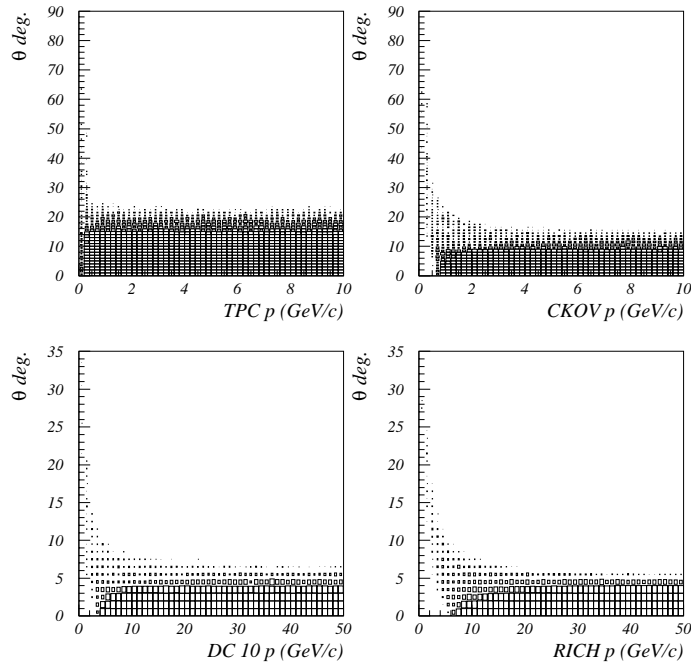ï   Single Booster batch = 5E12 protons. P-907 wants 10^8 to 10^9 protons most of the time. Increases to 10^{11} when running negatives.

ï   P-907 has proposed a new slow spill scheme ì Double Slow Spillî that provides two booster batches to anti-proton production in a period of ~ 3secs. We inject two booster batches. At the beginning of the flat-top, we give one batch to pbar and extract ~5-10% of the second batch to Meson. We then go off resonance. We have shown with simulation and actual measurement that the emittance of the batch returns to normal when we switch off the resonance circuits. We then give this batch to pbar. Details in FNAL-TM-2131.

New Double Slow Spill Scheme-Simulation results

ï **Ramp Structure**
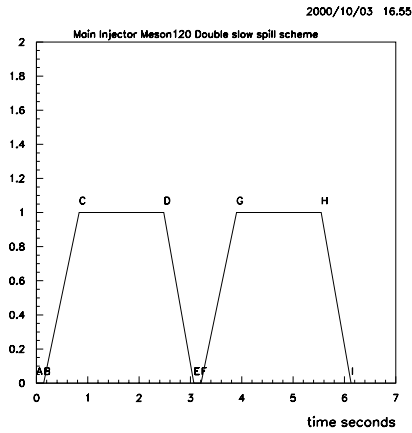
Emittance Before resonance
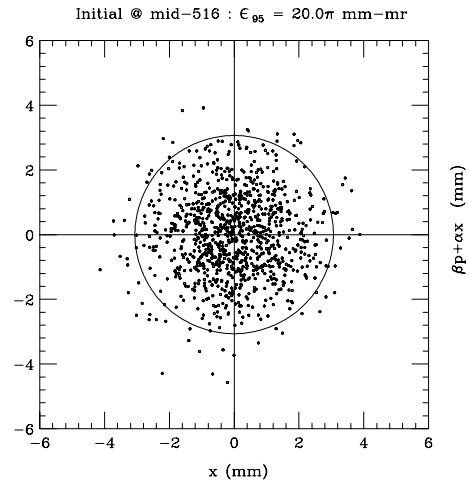
ï **Emittance at resonance**

ï

Emittance after resonance switched off.

New Double Slow Spill Scheme-Main Injector Measurements

Emittance Before resonance

ï   Emittance at resonance
ï

Emittance after resonance switched off.
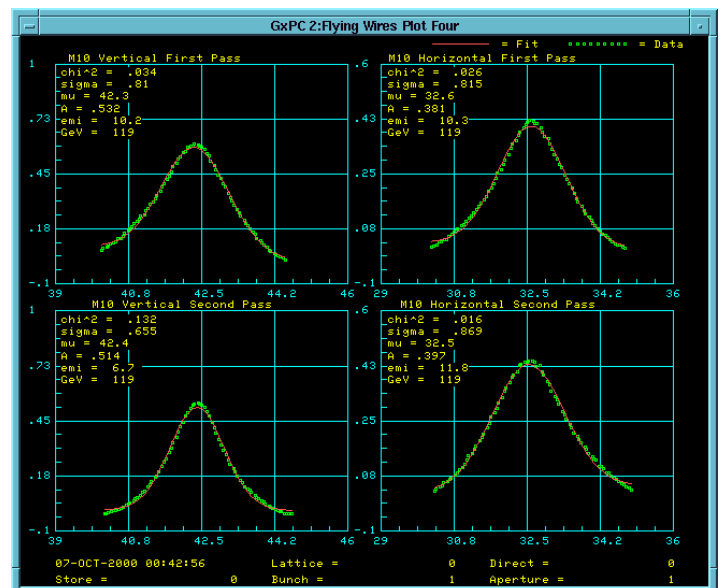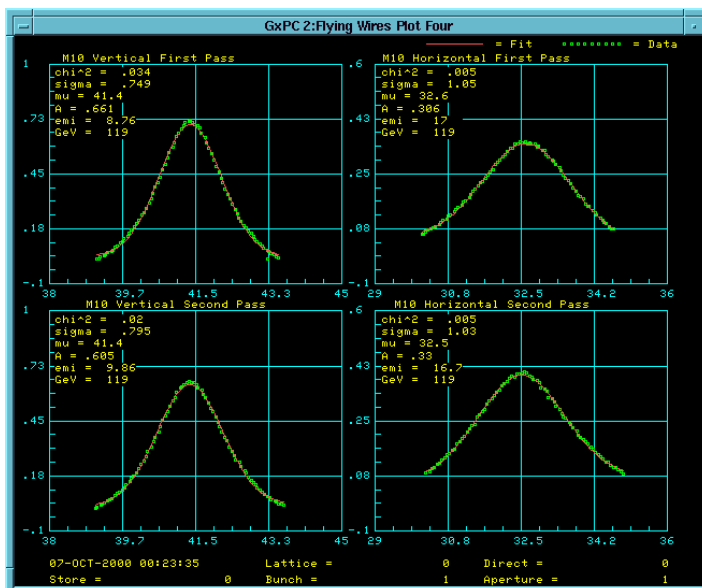
New Double Slow Spill Scheme-Main Injector Measurements

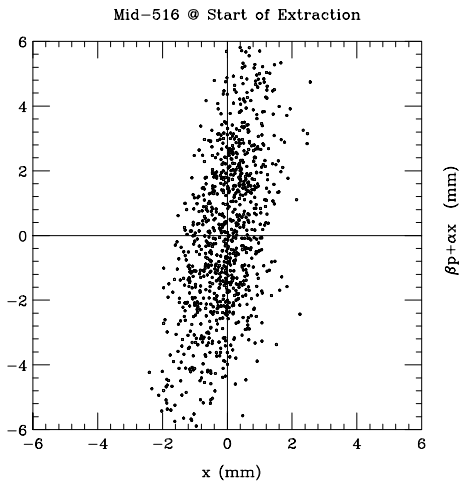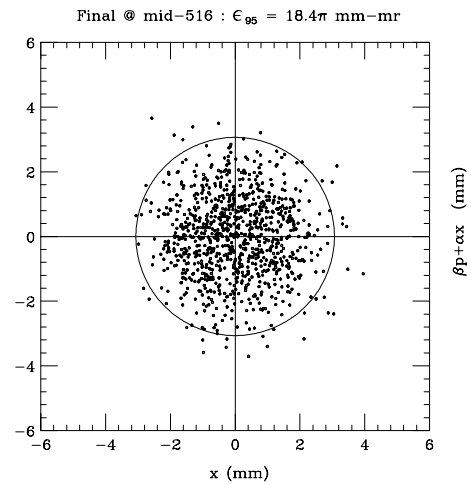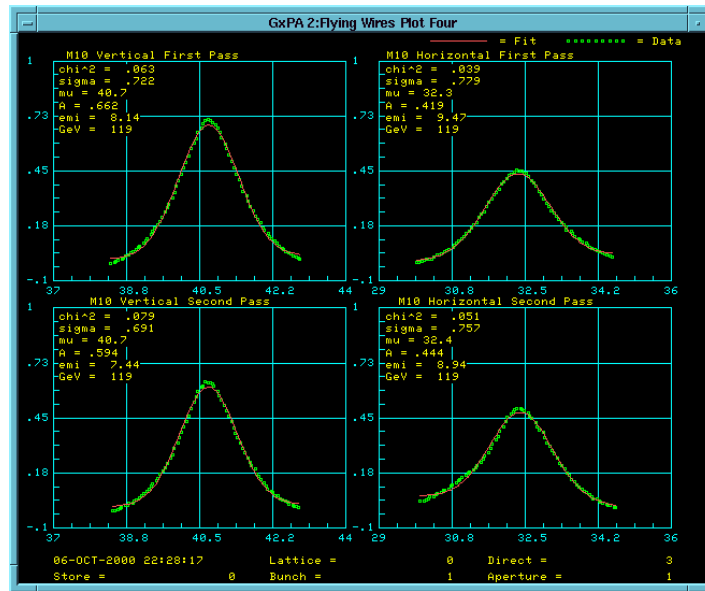Case 11 alternates 1 pure pbar cycle with one ì double Slow Spillî. This results in 2383 pbar shots per hr and 913 slow spill seconds per hour. 3% reduction in pbars and 76% of Meson intensity as in the proposal.

case	pure $\bar{p}$ spills	single slow spills	double slow spills	av. cycle time (secs)	av. power Gev^2	Av. flat-top time sec	slow spill secs per hr	$\bar{p}$ shots per hr
1	1	0	0	1.467	5200.	0.070	0.	2455.
2	0	1	0	2.667	9233.	1.250	1350.	1350.
3	0	0	1	3.066	9906.	1.649	1349.	2349.
4	1	2	0	2.267	8363.	0.857	1059.	1588.
5	1	1	0	2.067	7802.	0.660	871.	1742.
6	10	5	0	1.867	7121.	0.463	643.	1929.
7	10	4	0	1.809	6898.	0.407	568.	1990.
8	10	2	0	1.667	6276.	0.267	360.	2160.
9	10	1	0	1.576	5821.	0.177	208.	2285.
10	1	0	2	2.533	8997.	1.123	1089.	2369.
11	1	0	1	2.266	8383.	0.860	913.	2383.
12	10	0	5	2.000	7605.	0.596	690.	2400.
13	10	0	4	1.923	7343.	0.521	614.	2406.
14	10	0	2	1.733	6587.	0.333	398.	2423.
15	10	0	1	1.612	6014.	0.214	233.	2436.

Table 1: Parameters for various mixes of spills

ï This has found favor with the beams division. This preserves the antiproton production rate while simultaneously allowing slow spill to proceed.

Beam line requirements and rates

- The secondary beam will be tagged with two threshold Cerenkov counters. The three beam species of π,K and p can be tagged by demanding 1)that πís radiate in the first counter and Kís do not, 2) πís and Kís radiate in counter 2 and pís do not.
- Assume 60Hz data taking for TPC
- 1% target for protons
- 10^5 particles per spill
- One spill every 3 seconds
- 1 Year = 10^7 seconds
- Total number of interactions to tape = $3x10^6$, a million for each particle type of beam. This will take 126 hours of elapsed time.

Total amount of running time

1 data point = 3×10^6 events takes 126 hours elapsed time with 1 sec flat-top every 3 secs.

27.6 data points will take 4.7 months with the rates in the proposal.

With the new Double slow spill (Scheme #11, 1 pure pbar cycle alternating with one double spill), this time increases to 6.3 months.

Table 5: Running time requirements for various aspects of E907 running.

Target	"Physics"	Beam Energies	Beam Charges	factor (3×10^6 events/data point)	data points
NuMI 1	MINOS	1	1	3.3	3.3
NuMI 2	MINOS	1	1	3.3	3.3
H_2	scaling	12	2	1.0	24.0/4
N_2	atm. ν	3	2	0.5	3.0
O_2	atm. ν	3	2	0.5	3.0
Be	p-A	1	1	2.0	2.0
Be	survey	5	2	0.1	1.0
C	survey	5	2	0.1	1.0
Cu	p-A	1	1	2.0	2.0
Cu	survey	5	2	0.1	1.0
Pb	p-A	1	1	2.0	2.0
Pb	survey	5	2	0.1	1.0
total					26.6

Add one more data point for Petersonís measurements

MINOS fast spill and ì double slow spillî

ï When MINOS starts running (end of 2003), they will use a scheme whereby one booster batch gets sent to pbar and the remaining 5 booster batches get sent to MINOS in a fast spill. This spill has a cycle time of 1.87 sec. MINOS running alone will reduce the pbar- rate by by 21.6%.

ï It is possible to device a ì MINOS +P907 double slow spill schemeî where in we inject 5 booster batches (kickers firing limit to 5), give one to pbar, slow spill on remaining 4 , give 3 to Minos and 1 to pbar at end of slow spill. One alternates this with a MINOS+Pbar fast spill. Such a scheme will give 8 booster batches to MINOS in 4.936 seconds which will result in a reduction of 40% in MINOS luminosity! I.e. It is better not to run Slow spill when MINOS is running.

ï P907 should be completed before MINOS turns on.

Schedules- SY120 project

- ï   Thornton Murphy (SY120 leader) has given the following schedule for producng test beams in the MESON area. This will be done by Union Labor. Single Mechanical tech (1/2 FTE) to supervise.

- ï   file: cdr.short C. T. Murphy rev. 9/06/2000

- ï   A THUMBNAIL SKETCH OF THE SY120 PROJECT

- ï   The purpose of the SY120 project is to provide 120 GeV proton beams to three experiments or secondary beams in Meson and to the KAMI experiment in Neutrino. The major changes to the existing Switchyard are: - replacement of cryogenic bend strings with conventional 10' magnets (EPB dipoles), most notably the Left Bend to Meson - increase the frequency of quadrupoles to contain the lower energy beam sizes. - move the 3-way split septa from the F1 manhole to M01. We envisage the following phasing/schedule for the installation and commisioning:

- ï   1. Measure the emittances up to F17 (done, Jan. 2000).

- ï   2. Feb.-Sep. 2000: Design & build stands for bypass line in Transfer Hall. Install & power a B3 at F17 (done).

- ï   3. Nov.-Dec. 2000: Complete P3 line (F17-48: 6 WC's, 6 BPM's. Remove PSEPs.

- ï   4. Jan.-Feb. 2001: Install the bypass line in Transfer Hall and early Enclosure B. These areas are interlocked during Run II.

- ï   5. Mar.-Apr. 2001: Commission beam to the Switchyard Dump in Neutrino. Measure the emittance to reevaluate whether all the extra focussing will be necessary.

- ï   6. Mar.-Sep. 2001: Engineer, design, fabricate stands and other equipment for replacement of Left Bends

- ï   7. Oct.-Nov. 2001: Replace the Left Bend with EPB dipoles.

- ï   8. Dec. 2001: Build E907 (Raja) beam.

- ï   9. Jan.-Feb. 2002: Run beam to Meson test beam only, low intensity, with old quadrupole optics, despite some beam scraping.

- ï   10. Mar.-Jun. 2002: Split beam between MTest and E907, low intensity Ö

Funding profile of SY120 AIP project and optimal P907 schedule

ï FY00 291 k$

ï FY01 567 k$

ï FY02 762 k$

ï FY03 700 k$ --M-East, CKM etc

ï FY04 340 k$

ï If P-907 is delayed, the savings to SY120 is ~ $100K for building the P907 specific beam elements.

ï Optimal schedule for P907

ï 2001 Clean out Meson area and install E-907.

ï 2002 Run E-907

ï 2003 Analyze data from E-907

ï Delay us---and the collaboration will dissipate. Also, the TPC is in high demand. Berkeley Bevalac group will want it back.

P-907 Worklist

1)Beam ñ Part of SY120 project-C.T.Murphy, Ldr.

2)TPCó P.Barnes,S.Johnson,G.Rai(LBNL ñ consultant),R.Soltz,R.Raja,A.Para
Work to do- Install TPC in clean room, check out electronics and get it to trigger on cosmics. Debug Data Acquisition system
Resources-Phy/Eng/Tech 9/6/11 man weeks

3)Magnetsó PPD will get these installed
Work to do- Fix short in one JGG coil. Make sure Meson floor will support JGG
            Move TPL-B magnet to Meson. Install
Resources-Phy/Eng/Tech 2/8/10 man weeks

4)Chambers- J.Brack,J.Peterson,R.Ristinen,1 UCOL GS
Work to do-Clean the wires of E690 chambers, electronics from PREP,Install and debug
Resources-Phy/Eng/Tech 2/3/31 man weeks

5)Cerenkov- D.Asner,D.Wright,E.Hartouni
Work to do- Reassemble E690 Cerenkov after transportation from BNL, Install and debug
Resources-Phy/Eng/Tech 1/8/23 man weeks

P-907 Worklist

6)TOF system-
S.Mishra,T.Bergfeld,A.Godley,C.Rosenfeld(Uof S.Carolina)
Work to do-Reconfigure existing hodoscope array in P907 geometry, Install and debug
Resources-Phy/Eng/Tech 8/6/16 man weeks

7)RICH- Selex RICH ñR.Winston,E.Swallow, 1EFI PD, 1EFI GS
Work to do-Debug Russian phototubes. New gas, Transport from P-center Install and debug
 Resources-Phy/Eng/Tech 6/6/30 man weeks

8)EM+Had calorimeter- M.Longo, H.R.Gustafson,A.Lehmann,H-K Park(Michigan)
Work to do-Use existing NUSEA EM+Hadron calorimeter +Muon Veto. Transport from M-East, Install and debug
Resources-Phy/Eng/Tech 4/6/16 man weeks

9)Recoil detectoró L.Gutay, 1 Purdue GSÖ
Work to do-Use existing components of SELEX Silicon detector and fashion a recoil detector
Resources-Phy/Eng/Tech 16/16/24 man weeks

P-907 Worklist

10)Data Acquisition Systemó B.Cole,D.Prull,1 UCOL
PD, W.Mays,CD consultants on DART
Work to do- Coupled with TPC clean room
commissioning
Get DART to work for P-907
Resources-Phy/Eng/Tech 24/4/12 man weeks

12)Simulation--R.Soltz,R.Raja,P.Barnes,L.Pinsky,1
Houston GS
Work to do-Use existing simulation code from
RICH+TPC and get into data driven Geant321
framework
Resources-Phy/Eng/Tech 24/0/5 man weeks

13)Reconstruction and analysisó
N.Mokhov,M.Messier,L.Liu,S.Mashnik,A.Sierk,Y.Fisya
k ,G.Xu,E.Hartouni,J.Morfin

Work to do-Use TPC calibration and reconstruction
code. Use TPC 3D tracks to find tracks downstream.
Integrate RICH using existing RICH code. Integrate
Cerenkov using existing Cerenkov code. Write track
finder and fitter.
Resources-Phy/Eng/Tech 144/0/0

Conclusions

ï   We have proposed a low cost, high statistics , low systematics experiment to measure particle production on various targets with various beam momenta and types.

ï   The particle identification, rate, energy range and beam species capabilities of P-907 are unmatched by its competitors.

ï   The time window appropriate for the mounting and completion of E-907 would be 2001-2003.

ï   The measurements made would benefit our understanding of particle production dynamics in minimum bias interactions (99% of cross section), and in nuclear interactions.

ï   The measurements would also benefit the study of atmospheric neutrino interactions, Muon Collider/Neutrino factory target choices and also the MINOS experiment.

ï   The experimental team of proponents has had considerable experience in hadroproduction experiments.

ï   In addition to the hardware, large portions of software can be inherited from previous experiments (E-910 and SELEX) and reused.

NUSEA Calorimeter dimensions